



Geological and geophysical properties of cap rock in a natural CO₂ occurrence, Mihályi-Répcelak area, Western Hungary

Csilla Király (1), Ágnes Szamosfalvi (2), Eszter Sendula (1), Mariann Páles (1), István Kovács (2), Péter Kónya (2), György Falus (2), and Csaba Szabó (1)

(1) ELTE, Geography and Earth Sciences, Petrology and Geochemistry, LRG, Budapest, Hungary

(csilla.kiraly.hu@gmail.com, (+36-1) 381 2212), (2) Hungarian Geological and Geophysical Institute, Budapest, Hungary

The physical and geochemical consistency of the cap rock is primarily important for safe geological storage of CO₂. As a consequence of CO₂ injection reactions took place between the minerals of the reservoir, the cap rock and CO₂ saturated pore water. These reactions may change the mineral composition and petrophysical properties of the storage reservoir as well as the cap rock that provides the only physical barrier that retains carbon dioxide in the target reservoir formation.

Study of the natural CO₂ occurrences delivers information to understand which properties of a cap rock provide the sustainable closure and retainment. Knowledge of the long term effect of CO₂ on the behavior of the cap rock is an important input in the selection procedure of a potential CO₂ injection site. Yet, very few data exist on geochemical properties and reactivity of the cap rocks. During normal commercial operations the reservoir is typically cored, but not the cap rock.

This study may enhance our knowledge about possible mineralogical reactions, which can occur in clayey-aleuritic cap rocks. The Mihályi-Répcelak natural CO₂ occurrence is believed to be leakage safe. There is no known seepage on the surface. It is suggested that the aleuritic clay rich cap rock occurring at the natural reservoir can stop CO₂ migration into other reservoirs or to the surface. The most important characteristics of cap rocks that they have low permeability (<0.1 mD) and porosity (eff.por. = 4%) and high clayeyness (approx. 80%). However, we demonstrate that in addition to these parameters the geochemical properties of cap rock is also important.

In order to characterize the natural CO₂ occurrence, we applied the following analysis, like XRD, FTIR, SEM. The petrophysical properties are determined from the interpretation of geophysical well-logs and grain size distribution.

The most important result of this study that adequate petrophysical properties do not completely define the suitability of a cap rock. The effective porosity (~4 %), permeability (0.026 mD) and clayeyness (~80%) data imply that the studied aleurolites are good cap rocks. The mineral composition of cap rock is similar to that of reservoir rock, however, the ratio of components is different. The mineralogical analysis and petrography yield to the reaction between CO₂ and the cap rocks. The most visible effect of CO₂ presence is the dawsonite precipitation after albite dissolution within the cap rocks. Therefore, the CO₂ may migrate through the cap rocks in geological time scale, however the total system could be leakage safe.